

# VE7HWY Repeater

Theory of Operation and Construction Notes

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## **Overview**

The VE7HWY repeater is constructed from radio elements supplied by Hamtronics, Inc. and a repeater controller supplied by Hamtronix Embedded Systems. Each module is enclosed in a separate metal enclosure. It is important that the lids are properly screwed down during normal operation.

All interconnections between the modules are made using feed-through capacitors. These capacitors pass DC and low-frequency (audio), but block high frequency (RF).

The ground path for all components is via metal board stand-offs, metal enclosures, and the metal shelf assembly. If any module is removed for service, a ground path needs to be provided for correct operation.

## **VHF Receiver**

The VHF receiver is a Hamtronics R303 module. The module was supplied from the factory pre-tuned to 144.890 MHz. The frequency of the R303 cannot be adjusted in the field. It has to be sent back to the factory, or a replacement U1 ordered for the correct frequency.

Connector E2 is brought out in the event that an external speaker is required.

Use R25 to adjust the squelch. R25 is close to the RF connector.

## **VHF Transmitter**

The VHF transmitter is a Hamtronics T301 exciter and a Hamtronics LPA 2-15R power amplifier. These modules were supplied from the factory pre-tuned to 145.490 MHz. The frequency of the T301 module is adjustable using DIP switches. Please refer to the Hamtronics web site for the correct DIP switch settings. A complete re-alignment will be required if the frequency is changed.

The PA output transistor is bolted to the top lid. This bolt does not need to be loosened to remove the lid. If this bolt is removed, make sure that appropriate heat sink compound is re-applied to the transistor.

The PA amplifier outputs about 15W.

## **UHF Receiver**

The UHF receiver is a Hamtronics R306 module. The module was supplied from the factory pre-tuned to 448.775 MHz. The frequency of the R306 cannot be adjusted in the field. It has to be sent back to the factory, or a replacement U1 ordered for the correct frequency.

Connector E2 is brought out in the event that an external speaker is required.

Use R25 to adjust the squelch. R32 is close to the RF connector.

## **UHF Transmitter**

The UHF transmitter is a Hamtronics T304 exciter. These modules were supplied from the factory pre-tuned to 443.775 MHz. The frequency of the T304 module is adjustable using DIP switches. Please refer to the Hamtronics web site for the correct DIP switch settings. A complete re-alignment will be required if the frequency is changed.

The exciter outputs about 3W.

## **Controller Assembly**

The controller assembly consists of a Hamtronix Elektra 2000 controller, four TD5 CTCSS encoder/decoder boards, and some supporting logic.

Power is supplied via three separately fused inputs - VHF section (5A fuse), UHF section (3A fuse), and controller section (3A fuse). Power is then routed via three front-panel switches. These switches allow the individual components to be powered up separately - for example the UHF section can be left unpowered if it's not required. Physically switching the section off results in lower power consumption than just logically switching off the section using the controller.

The PTT output from the Elektra 2000 controller is an open-collector output. The transmitter boards (T301 and T304) require a 12V signal to transmit. This is accomplished by a pair of p-channel MOSFET transistors and pull-up resistors. If the transistors are removed from the chassis, please make sure that the insulating mica washer and plastic bushing are re-installed correctly. Heat sink compound is not required.

The TONE input for the VHF side of the controller (CN1-6) operates as an active-high input. The output from the TD5 board is active-low, therefore a 74LS06 open-collector inverter is used (along with a voltage regulator to provide 5v). The TONE input for the UHF side of the controller (CN2-6) behaves in the opposite way, therefore an inverter is

not required. I contacted Hamtronix technical support about the difference in behaviour (which is undocumented) but I did not receive an answer. A second inverter gate is available in the event that this behaviour changes with a future firmware upgrade.

The tone encoder boards are powered when the transmitters are powered. To disable the transmitted tone, set DIP switch 5 and 6 off, and 1,2,3,4 on. To adjust the encoded tone level, use R2 on the encoder boards.

The tone decoder boards are always powered. Tone decode can be enabled and disabled using controller codes. R2 has no effect on the decoder boards.